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Noise Levels Measurements at Ladipo and Yaba Markets in Lagos and the Adverse Effects on Humans

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Noise levels at Ladipo market in Mushin Local Government Area and Yaba market in Yaba Local Government Area of Lagos State were measured using a sound level meter (DSM Model 325, 32 dB-130 dB). Readings were taken for five consecutive days (Monday–Friday) at three different locations within each market between 9:30 am and 6:00 pm. At Ladipo market, the noise level (dB) ranged between 67.45 and 98.10, corresponding to the minimum and maximum values, respectively, while at Yaba market, the recorded level of noise (dB) was between 64.70 and 104.50. The mean values obtained from both markets exceeded the recommended safe noise level limit provided by the World Health Organization, thus posing deleterious health risks to people, and particularly traders in such environments.

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1. INTRODUCTION

Commercial activities in market places play a central role in the economic and social advancements of humans. They are, however, associated with a lot of health and environmental issues, including noise pollution. Noise emanating from market places is considered commercial noise and is capable of affecting the general public. Prolonged exposure to excessive noise has the ability to cause adverse health effects (physiological, psychological, and hearing loss) in humans [1]. On average, market activities in Lagos last for a duration of eight hours, during which people are exposed to various forms of noise. The cumulative effect of this could have some serious health implications for the people in the market. Noise may be defined as an unwanted sound emitted from different sources which is unpleasant to human hearing. It is produced in almost all human activities and can be classified as either occupational noise or environmental noise. Noise emanating from vehicles is the most common type of noise pollution [2]. According to Abert [3], pollution refers to the presence or introduction of substances, organisms, and forms of energy to substrates or media that they do not belong to, exceeding their typical quantities for enough time and under conditions that allow interference with the health or comfort of people, damaging natural resources, or altering the ecological balance of an area.

Vehicular noise from highways and other roads could be associated with the volume of traffic, the speed of the traffic, and the number of trucks in traffic flow. The negative effects of noise pollution on human health are multifarious. These include but are not limited to annoyance, insomnia, low productivity at work, permanent ringing or buzzing in the ears, sleep disturbance and fatigue, psychological stress and stress-related disease, psychological changes in heart beat, and increased blood pressure [4]. The most conspicuous effect of noise pollution is damage to human hearing ability, which may be temporary or permanent depending on the exposure time [5]. A report by the World Health Organization [6] revealed that 16% of the disabling hearing loss in adults is attributed to occupational noise [7]. Sound is widely regarded as a mechanical wave coming from a source and can travel through solids (walls), liquids and gas have an audible frequency range. If a sound is not pleasant to hear, it is widely regarded as noise. Sound is generally transmitted through two types of waves—longitudinal waves and transverse waves. Longitudinal waves occur when the oscillations are parallel to the direction of travel. Transverse waves occur when the oscillations are perpendicular to the direction in which the wave travels. Sound is a common part of everyday human life. The sound can be pleasant (wanted) or unpleasant (unwanted). When it is unpleasant to the human ear, it is known as noise. Excessive noise can also impact our ability to concentrate and perform tasks effectively, and accordingly. More so, it is important to take steps to reduce noise pollution in our surroundings by installing sound – proofing materials and enforcing noise ordinances in public areas.

Noise is an unwanted sound considered unpleasant, loud, or disruptive to hearing. From a physics standpoint, there is no distinction between noise and desired sound, as both are vibrations through a medium, such as air or water. The difference arises when the brain receives and perceives a sound. Existing epidemiological research assessing the links between environmental noise and human health has provided initial evidence to suggest that such noise exposure can be injurious to an individual's health. Over the last thirty years, a large number of studies have been conducted to determine if and to what extent exposure to noise negatively affects our health. However, it has only been within the past twenty years that studies have made strides towards understanding the relationship between noise exposure and cardiovascular health [8]. While occupational noise studies have provided evidence linking workplace noise exposure to hypertension [9], only within the past fifteen years, however, have epidemiological studies begun to centre the discussion on transportation noise and cardiovascular health. This literature review will focus on more recent epidemiological studies on transportation noise exposure and cardiovascular health outcomes published during the past ten years, with special emphasis on the most recent studies.

Tobias [10] examined the short-term effects of environmental noise levels on the daily emergency admissions in Madrid, Spain between 1995 -1997. All causes of emergency admissions and separately, circulatory and respiratory

related admissions, were considered. Descriptive statistics on community noise levels showed that under WHO guidelines, there were high noise levels (more than 65 dB) for more than 90% of the day. [8] assessed the relationship between road traffic noise exposure and the prevalence of hypertension in Groningen City, Netherlands, using a random sample of inhabitants of the city and individuals who were participating in the Prevention of Renal and Vascular End-Stage Disease (PREVEND) study. All participants were between the ages of 28 and 75 and completed a detailed questionnaire on demographics; cardiovascular, renal, and family medical history; use of anti-hypertensive medication; and smoking status. Hypertension was defined as systolic blood pressure ≥ 140 mm Hg, diastolic blood pressure ≥ 90 mm Hg, or use of anti-hypertensive medication based on pharmacy reports. Road traffic noise was calculated using a noise propagation model. A logistic regression model was used to determine the association between exposure to road traffic noise and hypertension. In both the City of Groningen and individuals in the PREVEND cohort, subjects with hypertension were found to reside in areas with higher average noise levels -- 53.3 dB versus 54.6 dB in the City of Groningen sample and 52.8 dB versus 54.3 dB in the PREVEND cohort. Additionally, individuals with hypertension were more frequently exposed to noise levels greater than 55 dB.

Odds ratios (ORs) within the City of Groningen sample showed that noise levels greater than or equal to 55 dB had statistically significant associations with self-reported use of medication for hypertension. Specific odds ratios with 95% confidence intervals in parenthesis are 1.31 (1.25 – 1.37), 1.01 (0.96 – 1.06), 1.01 (0.96 – 1.06), and 1.03 (0.96 – 1.11) for an unadjusted, age and sex adjusted, full, and full plus PM10 models, respectively. For the PREVEND Cohort only in the unadjusted model did significant associations exist between hypertension and noise levels greater than 55 dB OR = 1.35 (1.27-1.45).

[11] set out to determine the risk of road traffic noise for the incidence of myocardial infarction (MI) using a matched case-control study design within the city of Berlin, Germany. Eligible patients were enrolled over a period of three years from 1998 – 2001, and included those consecutively admitted to 32 major hospitals in Berlin with confirmed diagnosis of acute MI or survivors of sudden cardiac arrest [6] between the ages of 20 and 69. Hospital controls were individually matched according to sex, age, and hospital. Additionally, controls such as the home environment, socio-demographics, family history of MI, smoking, educational level, marital status, employment status, working hours, and noise sensitivity were obtained using standardized interviews. In 2008, [12] investigated the effects of urban road traffic noise on children's blood pressure and heart rate. A cross sectional study was performed on 328 preschool children aged 3-7 years, who attended 10 public kindergartens in Belgrade, Serbia. Children's blood pressure was measured using a mercury sphygmomanometer and their heart rate was counted by radial artery palpitation for 1 minute. Noise exposure was measured during the night using the front of the children's residence and during the day using the front of their schools. Resident noise was categorized as noisy if levels exceeded 45 dB(A) and quiet if levels were ≤ 45 dB(A). School noise was categorized as quiet if daily noise levels were ≤ 60 dB(A) and loud if daily noise levels were greater than 60 dB(A).

[13] sought to simultaneously analyze the role of exposure to noise and air pollution from road traffic in the risk of MI. This study was based on the Stockholm Heart Epidemiology Program, which was conducted in Stockholm County, Sweden. In total, 3,666 study subjects were included, which consisted of 1,571 cases and 2,095 controls. Hypertension was defined as reported use of antihypertensive drugs, or as a systolic blood pressure of 170 mm Hg or higher, or a diastolic pressure of 95 mm Hg or higher.

The road traffic sound level was estimated using a noise propagation model. In 2003, a supplementary questionnaire was distributed to enhance the noise exposure assessment. This included questions on hearing impairment, window insulation, bedroom orientation, and noise annoyance.

2. MATERIALS AND METHODS

2.1 Sample Area

Two popular and very busy markets in Lagos state were selected for the purpose of this research. These were Ladipo Market and Yaba Market (Longitude 3.301 East & Latitude 6.5086 North), Yaba. Ladipo Market (Latitude 6.6327 North and Longitude 3.3391 East degrees) also known as Ladipo Auto Spare Parts Market is a market located in Mushin local Government area of Lagos State. It is the greatest market for

Fig. 1. Sound level meter Source: Google

buying vehicle parts in the entirety of Africa. It is a decent hotspot for both used ('tokunbo') and new auto extra parts in Nigeria, [14]. Yaba Market, on the other hand is a general- purpose market where all types of wares and foodstuff are sold.

2.2 Instrumentation

A sound level meter (Model DSM 325) was employed in the measurement of the noise level in the markets (Fig. 1). The instrument has a measuring range of 32 dB to 130 dB. It was calibrated using standards traceable to the National Institute of Standards and Technology (NIST/USA).

Measurements were taken at three different locations within the markets for 5 consecutive days within the periods of 9.30 - 11.00 am (morning), 1.30 -3.30 pm (afternoon) and 4.30 – 6.30 pm (evening) respectively. The locations are represented as A, B and C and their interpretations are as follows:

Location A – An intersecting point of several walkways within the market

Location B – A point along major vehicular routes

Location C – Main entry point to the market closest to the highway

The sound meter was switched on at each spot and measurement was taken for a period of 3 minutes at each location. The minimum and maximum values of the sound level within the period were noted. The measurement was repeated and the average measurement was computed.

3. RESULTS AND DISCUSSION

3.1 Results

The mean sound levels measurements at Ladipo and Yaba markets are presented in Tables 1 and 2 respectively.

The noise levels (dB) ranged between a minimum value of 67.45 and a maximum value of 98.10 at Ladipo market. At Yaba market, the recorded noise levels were between 64.70 dB and 104.50 dB. The results are within the noise levels obtained at Oil mill market in Port Harcourt [1] and Kataku market in Plateau [15]. From Figs. 2 and 3., it could be deduced that the noise levels are least in the morning hours and greatest in the evening. This is expected since the traders do not all get to their shops at the same time in the morning and as such business activities would still be minimal. It follows that peak activities are usually in the evening in both markets.

Axis C recorded highest noise levels irrespective of the time of the day while axis A recorded the least noise levels in both markets. The C- axis, it would be recalled is the main entry point to the market, closest to the highway. It is thus expected that both human and vehicular movement, which also includes the hooting and honking of the vehicles, trucks, motorcycles etc. would be the highest as such a period, which could be a likely cause of the increased noise levels.

In order to examine which day in the week records the lowest and highest noise levels in the markets, the average noise levels from measurements taken in the morning, afternoon and evening on each day of the week

and for each specific location were obtained. The results are displayed in Figs. 3 and 4. At Ladipo market, the highest noise level of 94.38 dB was recorded on Tuesday.

At the C axis. The commercial activities in a nearby major market (Aswani market), which opens only on Tuesdays might have a contributory impact on the cumulative noise levels at Ladipo market on such a day. At Yaba market, the highest noise level of 95.57 dB was recorded on Friday evening. The evening rush by people either to make purchases for the weekend or leave the market for home might result in a traffic build up and consequent increase in the noise levels especially along the highways close to the market as suggested by the location of interest (i.e., axis C).

3.2 Noise Exposure Risks at Both Markets

The Federal Environmental Protection Agency (FEPA) set a guideline on the permissible limit and duration of exposure to noise as seen in Table 3. Continuous exposure to noise of 90 dBA isn't expected to last more than 8 hours continuously. Trading activities at both Ladipo and Yaba markets lasts for an average duration of eight hours each day. On a day such as Tuesday at Ladipo market and Friday at Yaba market where the noise level exceeds 90 dB, the traders would be at some health risks associated with noise.

Table 1. Mean sound levels (dB) at ladipo market

Day	Location	Morning		Afternoon		Evening	
		Min	Max	Min	Max	Min	Max
Monday	A	67.85	80.15	65.05	76.75	77.95	87.80
	B	74.65	86.85	70.90	85.55	82.45	89.30
	C	81.05	91.65	83.60	89.25	83.15	94.60
Tuesday	A	67.45	79.45	64.45	75.95	74.80	86.10
	B	76.65	83.50	72.10	84.80	86.95	87.05
	C	82.05	93.80	85.40	91.30	84.15	98.05
Wednesday	A	70.35	77.35	75.00	80.75	77.55	88.30
	B	74.70	87.80	72.10	85.55	83.60	90.25
	C	79.10	91.65	80.85	94.25	85.20	92.25
Thursday	A	73.60	77.30	76.95	77.55	78.00	91.70
	B	77.15	88.50	75.60	84.45	83.50	88.65
	C	79.15	93.65	80.85	93.75	86.45	93.15
Friday	A	69.30	76.90	64.45	81.45	75.95	85.20
	B	75.60	84.00	71.60	84.80	84.25	87.70
	C	82.05	92.80	86.25	91.25	84.25	98.10

Table 2. Mean sound levels (dB) at Yaba Market

Day	Location	Morning		Afternoon		Evening	
		Min	Max	Min	Max	Min	Max
Monday	A	65.55	79.80	64.95	75.90	77.25	86.25
	B	72.65	83.15	72.65	85.25	83.90	95.80
	C	82.30	89.25	83.35	91.60	81.85	93.45
Tuesday	A	70.30	74.75	76.95	78.20	72.55	86.60
	B	76.55	88.90	75.60	84.65	84.35	89.15
	C	84.00	88.90	76.85	92.75	81.25	92.35
Wednesday	A	66.80	67.95	64.70	79.70	74.55	85.10
	B	67.15	84.00	72.90	85.55	86.60	89.10
	C	82.05	92.65	86.75	88.75	81.30	84.20
Thursday	A	67.85	80.65	65.05	79.40	73.90	87.80
	B	75.15	83.10	70.90	85.05	86.30	89.30
	C	81.05	90.65	81.20	89.25	80.55	91.30
Friday	A	65.95	82.30	67.20	79.45	74.80	82.95
	B	76.65	83.50	72.10	84.80	82.45	84.85
	C	84.05	90.80	85.40	104.50	84.15	91.40

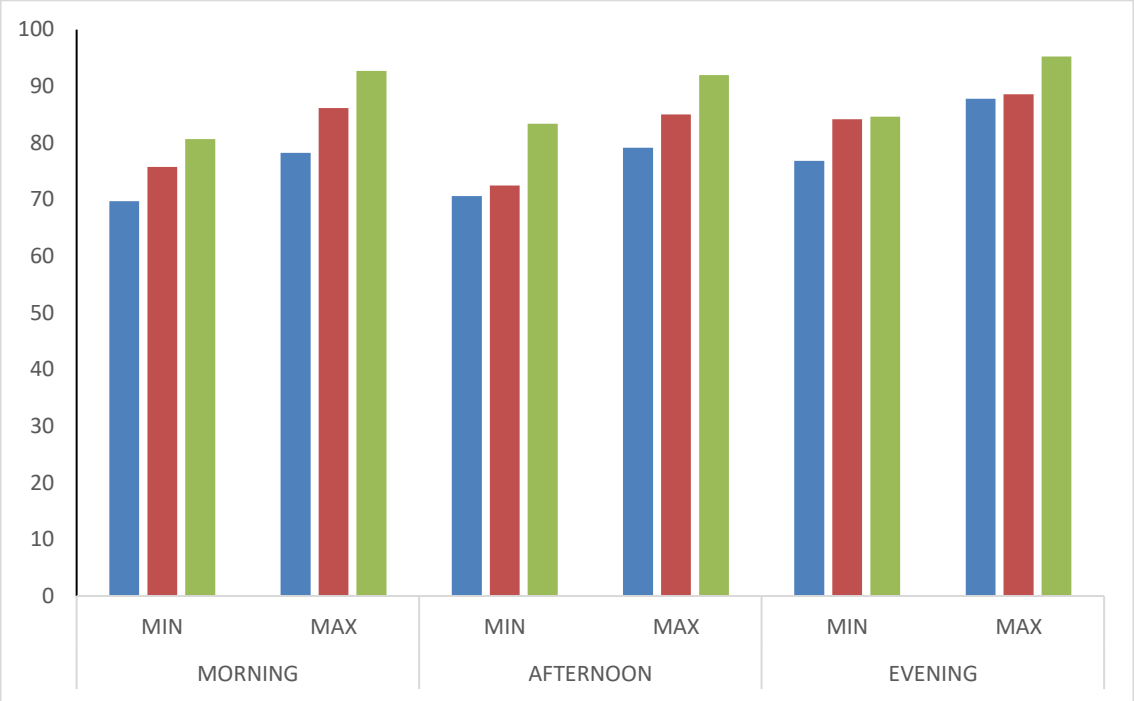

Fig. 2. Mean noise levels (dB) at Ladipo market

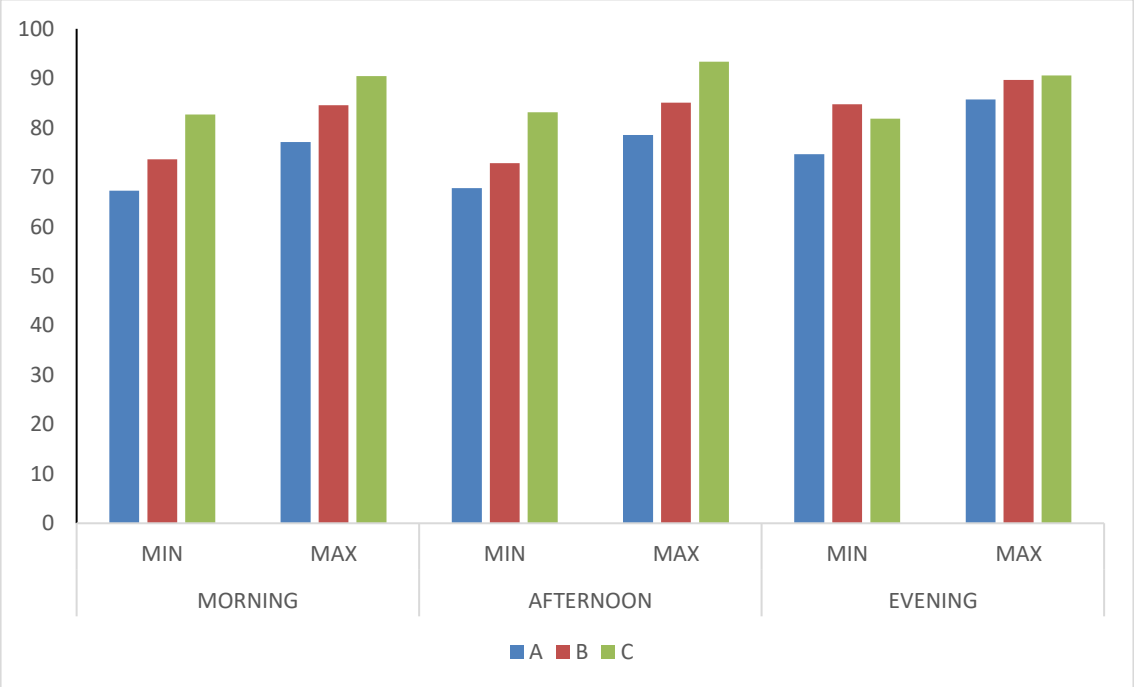

Fig. 3. Mean noise levels (dB) at Yaba market

Table 3. Nigeria noise exposure limit

Duration (hours)	8.0	6.0	4.0	3.0	2.0	1.5	1.0	0.5	≥0.25
Permissible exposure limit (dBA)	90	92	95	97	100	102	105	110	115

Source: FEPA. Guidelines and standards for environmental pollution control in Nigeria.1991 [16]

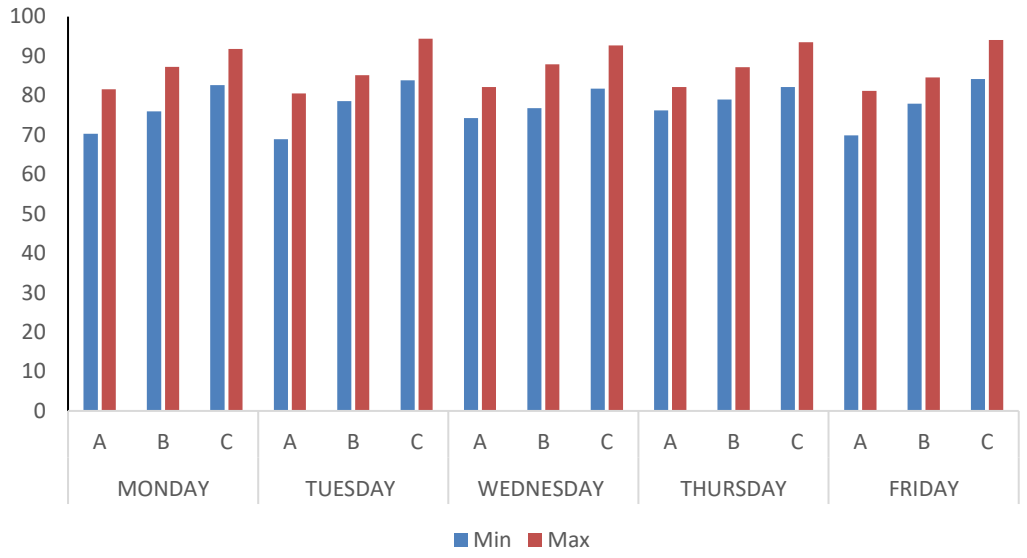

Fig. 4. Mean noise levels during Monday to Friday at Ladipo market

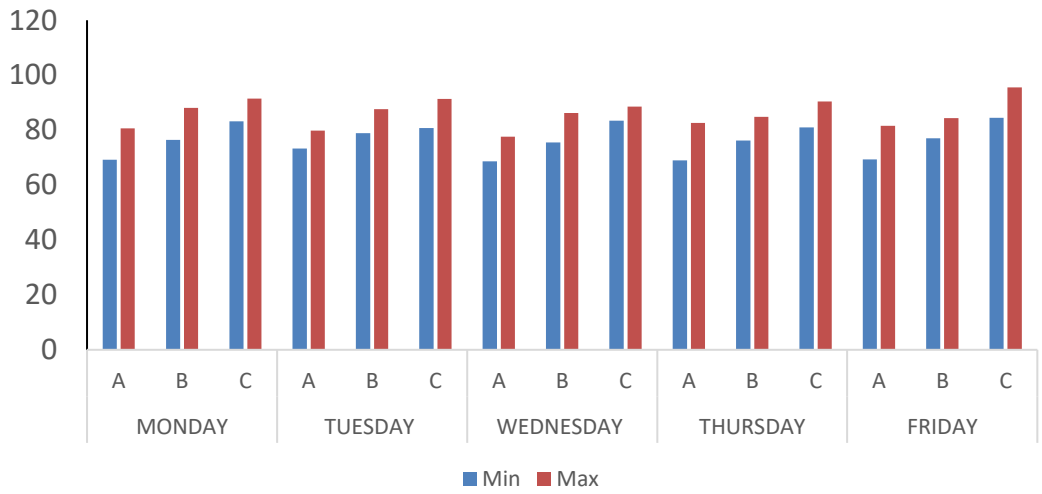

Fig. 5. Mean noise levels during monday to friday at yaba market

Aliyu and Tsamiya [16] reported that any sound above 85 dB can cause hearing loss. This is likely to be the case at both Ladipo and Yaba market for traders who are situated at locations B and C as the mean sound levels on nearly all the days the measurements were carried out exceeded this value.

The world health organization set a reference noise level limit of 70 dBA for commercial places for daytime period between 7.00 am and 10.00 pm [16]. The mean maximum noise levels recorded in all locations where measurements were taken in both markets exceeded this value, thus posing some health risks to the traders in the markets.

The overall average noise levels of 82.3 dB and 81.2 dB at Ladipo and Yaba markets respectively is unsatisfactory since noise of such magnitude inhibits full intelligibility in listeners with normal hearing and could predispose to other psycho-physical anomalies according to individual susceptibilities and noise exposed years. The chronic noise emanating from varied sources could constitute obvious health hazard of different classes and magnitude including cardiovascular disorders. Sorensen [17] noted

that a 10 dB increase in chronic exposition of noise in humans increases the risk of cardiovascular accident (CVA) by 14% and systolic blood pressure appreciation by 0.26 mmHg.

Furthermore, Erikson [18] postulated that a persistent noise level ≥50 dB is associated with the risk of CVD. Some experimental studies also demonstrated interference with the brain cortical maturation following chronic exposition to noise hence the need for situating institutions of learning and residential homes in a serene environment.

4. CONCLUSION

The noise levels at Ladipo and Yaba markets have been measured using a sound level meter (Model DSM 325) for 5 consecutive days within the periods of 9.30 -11.00 am, 1.30 -3.30 pm and 4.30 – 6.30 pm corresponding to the morning, afternoon and evening respectively. The mean noise levels (dB) were between 68.90 – 94.38 and 68.68 – 95.57 at Ladipo and Yaba markets respectively. The mean of the maximum noise levels in both markets were above the World Health Organization's reference noise level limit of 70 dBA for commercial places [16] thus posing some health risks to the traders in the markets, especially on prolonged exposure to such noise levels.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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